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Intelligent Traffic Management System (ITMS) for Smart Cities

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ABSTRACT

Nowadays traffic anomalies are reaching at its peak value and have become a common mishap on road. Vehicles on zebra crossing, breaking signal rules, traffic jam etc are different anomalies associated with road traffic problems. The manual process to handle such traffic rule violation is difficult, time consuming and required more manpower. Hence to avoid the limitation of the existing system, an automated traffic assistance system has been proposed. In the proposed system, three traffic anomalies i.e., road traffic jam based on total density of count of vehicles present on road, Vehicles on zebra crossing and detection of arrival of ambulance are topics considered for implementation

Keywords: Traffic, raspberry pi, image processing, automatic signaling system, Region of Interest.

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I. INTRODUCTION

Most of the mishap on roads are result of violation of traffic rules, driving with high speed, not driving on correct lane etc. Thus, traffic management is the important task to reduce the accident and traffic congestion. To detect road traffic congestion and traffic rule violation, a system based on automation develop. In the proposed approach, we are developing the image processing and computer vision-based system In this system, we will focusing on the three traffic violations,

1. Vehicle on zebra crossing.
2. Traffic congestion.

Vehicle on zebra crossing

Based upon geometrical structure of zebra-crossing the project proposes a framework for zebra-crossing detection anomalies. The zebra-crossing stripe's edges are in the form of sorted order which is its unique geometrical feature. Different images of zebra crossing are used for evaluation of the framework proposed and outcome achieved determines accuracy. If the vehicle found on the zebra crossing the image of the vehicle is capture and stored in the database.

Traffic Congestion

Dynamic traffic management will reduce the traffic congestion. Stationary cameras capture the video. Then images from the live videos are retrieved one frame in a second. Image processing is performed over these retrieved frames. Number of vehicles coming from a particular direction is the result obtained from the algorithm, image processing. By applying an algorithm based on real time traffic management, which by synchronizing every adjoining signals and managing the time duration of the signal accordingly controls the traffic signal.

II. LITERATURE REVIEW

Vismay Pandit et al. [1] proposed paper highlights on image processing as best way of monitoring the state change in traffic light. It can be consistent in detecting vehicle presence because it uses actual traffic image. Overall, the system is good but it still needs improvement to achieve 100% accuracy.

Optimal Traffic Signal Control for Alleviation of Congestion based on Traffic Density Prediction by Model Predictive Control by Hiroaki Nakanishi and Toru Namerikawa [2]. In this paper the proposed system for controlling traffic signal is achieved by examining relation between density of traffic and green time using numerical simulation.

Camera auto calibration using zooming and zebra-crossing for traffic monitoring applications by S Alvarez et. al. [3]. In this system to obtain cameras automatic calibration an extraction of principal point and vanishing point is obtained. This calibration is useful for metric recovery of an image.

Smart Autonomous Traffic Light Switching by Traffic Density Measurement through Sensors by Y M Jagadeesh, G. Merlin Suba, S Karthik, and K Yokesh [4]. The proposed system focuses on implementation of Sensor based traffic light system with a dynamic control which enables to decrease the ATWT i.e Average Trip Waiting Time.

Real-Time Human Sitting Posture Detection Using Mobile Devices by Jheanel E. Estrada, Larry A. Vea [5], in this paper the proposed model implements some well-known classifier such as Decision Tree, KNN, SVM, MLP. The model performance accuracy was estimated 96.13% and had kappa value of 0.921.

Real time traffic congestion and detection using images by Revnath Somayajula [6] have found system that detects approximately 45%of the actual incidents. With use of Machine learning, the accuracy of the system can be made more accurate.

Real-time Road Congestion Detection Based on Image Texture Analysis by Li Wei & Dai hong-Ying [7]. In this proposed system traffic congestion was identified using texture analysis and feature extraction. Density of vehicle is obtained by extracting texture feature which is most unique approach.

A Technique on Road Traffic Analysis Using Image Processing by Prinyanka Khanke and members [8]. In this paper the aim was on implementing of image processing, for pattern recognition and computer vision algorithms. Modified algorithms were used for making it suitable for real-time road monitoring.

Better region proposals for pedestrian detection with R-CNN by Dong P, Wang W[9]. In this paper the proposed system utilizes a special region proposal algorithm based on ACF along with R-CNN. An Intelligent Traffic Load Prediction Based Adaptive Channel Assignment Algorithm in SDN-IoT by Zubair Md. Fadlullah & members [18] has proposed a system to find out future traffic load and congestion using DPPCOA and TP-DLPCOA algorithms.

III. PROPOSED SYSTEM

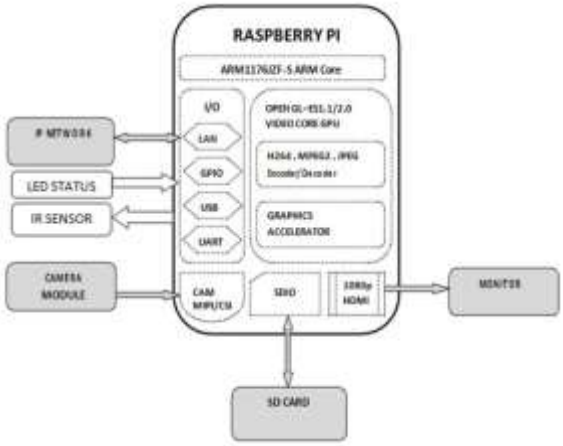

Fig.1. Block diagram of proposed system.

In proposed system instead of preferring the length of traffic on road or implementing the ITMS using costly techniques like gateway or gsm module we are proposing a design which should be economical w.r.t components used and have simple design instead.

The data of traffic density of particular area is to be given to raspberry pi using information of traffic recorded by camera. And according to density of traffic provided by respective road signal will be allotted max time interval which is set in signal system whereas the time interval of letting traffic go of road with less density will be deducted by some factor depending on where the signal is installed,

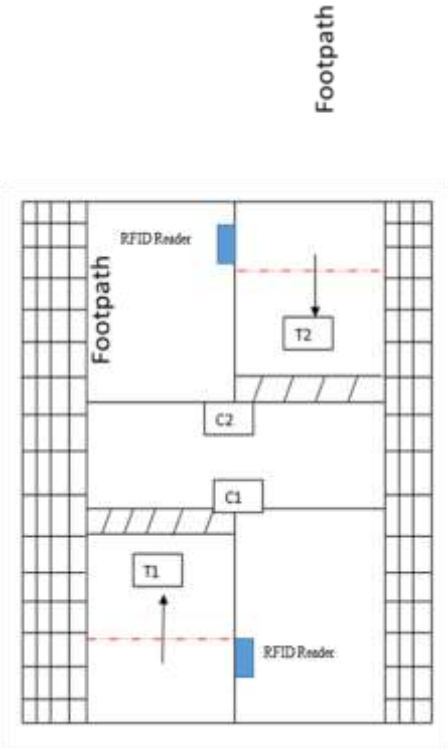

Fig. 2. Conceptual figure of proposed system.

C1 is camera 1 and C2 is camera 2 placed at opposite to camera 1. C1 monitor the activity at opposite side (near C1) and vice versa. For prototype we consider the two-way signalling system. The system will be develop using OpenCV image processing library and raspberry pi hardware. This system is mainly focus on three anomalies. i.e. Vehicle of zebra crossing, automatic signalling system based on traffic density and vehicle on footpath.

If the red light on the signal 1 is ON, then camera mount near signal 1 i.e.C1 monitor the activity near signal 2. if vehicle is found on zebra crossing then camera automatically save the image in the raspberry pi, at the same time it will observe the density of vehicle on both side and according to the density signal timing will updated. The anomaly at footpath is monitoring regularly. Same procedure is for Signal 2.

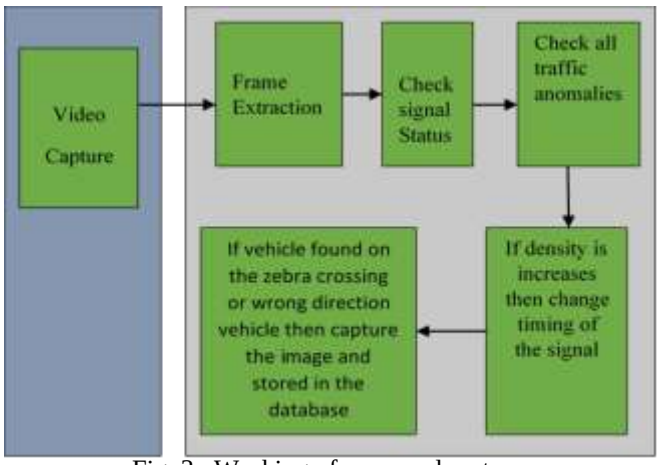

Fig. 3. Working of proposed system.

IV. FLOWCHARTS

The flowchart of the proposed system is as shown in Fig. 4, Fig.5.Algorithm for flowchart in Fig.3 for traffic density.

1. Start
2. Capture video from the web camera
3. Extracts the frames
4. Select Region of interest (ROI) as a zebra crossing
5. Convert the RGB image into grayscale
6. If any object found in the ROI region then frame is stored as anomalous frame Analyse the frame for number plate detection
7. End.

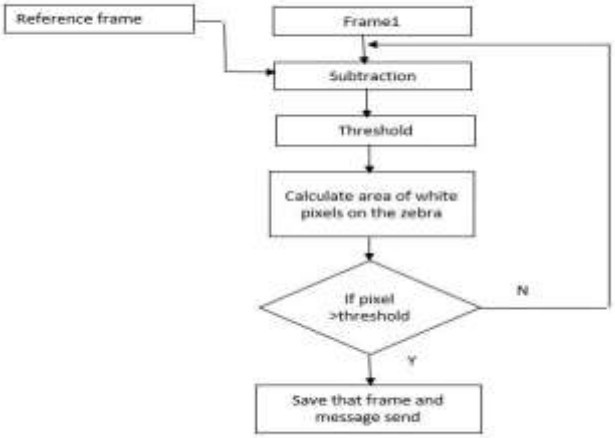

Fig.4.Flowchart for tragic density.

Algorithm for flowchart in Fig.5. for vehicle detection on zebra crossing.

1) Start.
2) Capture video from the web camera.
3) Extracts the frames.
4) Select ROI for maximum limit of traffic.
5) Convert the RGB image into grayscale.
6) Convert the grey image into binary using thresholding.
7) Calculate the density of binary object in the scene.
8) End.

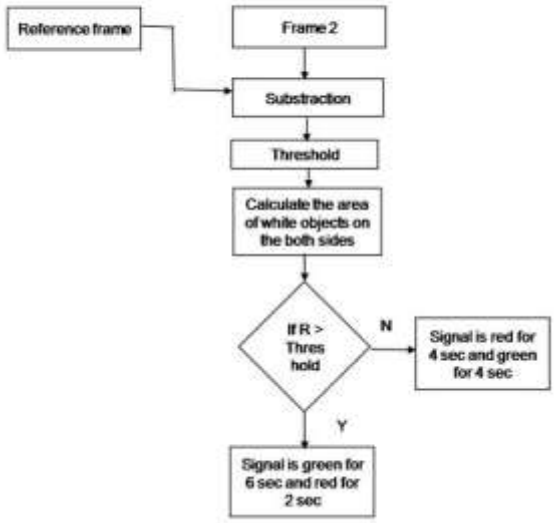

Fig.5.Flowchart for traffic density.

V. RESULTS

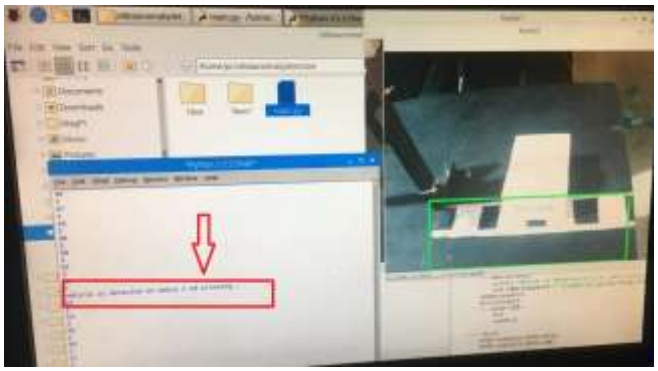

Fig.6.Detection of vehicle on footpath.

Fig.7.When density of vehicle is more on other side of road, a red light will be indicated by signal on road with less density of vehicle.

VI. CONCLUSION

This project will help reduce the anomalies and traffic rule violations at traffic junctions by strictly monitoring and punishing anomalous activities thus preventing accidents. This project will also help regulate traffic by allowing high density traffic to flow for more time and low-density traffic for less time thus leading to decongestion. This will make traffic flow efficient and will save time to the great extent.

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